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HOUSEHOLDS' WILLINGNESS TO PAY FOR SOLID WASTE MANAGEMENT SERVICES IN LOC NINH COMMUNE, DONG HOI CITY

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ABSTRACT

The willingness to pay (WTP) for environmental sanitation fee was examined with an aim to estimate the average WTP of local residents in Loc Ninh commune, Dong Hoi city, and to analyze a number of factors influencing the WTP level. Ninety six households were selected with a *Stratified Random Sampling* technique and interviewed with structured questionnaires on different fee levels that they were willing to pay for. The analysis results processed with *Weighted Average Method* showed that the average WTP was 18,440 VND/month. The highest and lowest WTP per month were 26,000÷29,000 VND/month and 17,000 VND/month, respectively. Based on *Regression Analysis Model* added in the Analysis Toolpak of MS. Excel, this paper investigated 4 key demographic characteristics of respondents; namely age, sex, occupation and per capita income which likely affected the WTP level. Of which, education and per capita income greatly influenced the WTP, i.e. respondents with higher levels of these factors showed higher level of WTP. In terms of occupation, the WTP of those residents who were engaged in farming were lower than that of other surveyed occupations.

Keywords: willingness to pay, household solid waste, fee, influencing factors.

1. INTRODUCTION

Although various policy instruments concerning the solid waste management have been in place, their effectiveness might vary between communities. For instance, the pricing policy based on the volume of domestic solid waste has proved unsuccessful in many developing countries because its actual volume generated by each household has been unable to identify. Therefore, the pricing of domestic solid waste management services (also known as environmental sanitation fee in Vietnam) is often fixed at a flat rate by waste management authorities and paid by each household on a monthly basis [1]. Under this circumstance, it is needed to examine how much money that the local residents would be willing to pay for solid waste management services, and ultimately for the environmental quality.

A number of studies carried out in developing countries showed that some demographic

characteristics such as age, per capita income, occupation, educational, etc. significantly affect the households' willingness to pay (WTP) for solid waste management services. Of which, Seth et al. [3] applied the contingent valuation method to predict influencing factors of households' WTP for solid waste management in Techiman-North district, Ghana. They found that some determinants (influencing factors) such as income, education, occupation and age had a significant influence on the WTP of local residents.

Like in other cities in Vietnam, the payment of local residents in Dong Hoi city for solid waste management is much below the actual cost of its collection, transport and treatment [3]. As a matter of fact, the solid waste management which solely depends on the government funding are not sustainable in the long run. In other words, the financial contribution of solid waste generators is very crucial to the success of any solid waste management program. Thus, the WTP or not to pay have a crucial impact on the reliability and success of any solid waste management strategy [5]. This paper, while regards Loc Ninh commune in Dong Hoi city as a case study to point out different levels of WTP, tries to analyze some determinants influencing the WTP.

2. METHODS

The data collection was made by means of interviews with structure questionnaire. The formula of Cochran [2] with desired error margin of 10% was used to determine the sample size of 96 households living in the study area, which were selected with *Stratified Random Sampling* technique. The respondents were asked about their WTP or not to pay for the different levels of environmental sanitation fee, and about reasons for their willingness or unwillingness.

In this study, 4 key independent variables, which probably affect the WTP levels (dependent variables), were taken into account. The independent variables included per capita income (Inc), occupation (Occ), age (A) and education (Edu). The WTP was described with the following function:

$$WTP = f(Edu, Occ, Inc, Ag) \quad (1)$$

Given small sample size and simple statisstic requirements, the collected data were processed with *Analysis ToolPak* added in MS. Excel. This free programme provides 18 statistical tools including Correlation and Regression. The influence of respodents' demographic charasteristics on WTP was assessed on the basis of Multiple Regression equation as follows:

$$WTP_i = \beta_0 + \beta_1 Edu_i + \beta_2 Inc_i + \beta_3 Ag_i + \beta_4 D_{1i} + \beta_5 D_{2i} + \beta_6 D_{3i} + \beta_7 D_{4i} + u_i \quad (2)$$

where i is respondent at i (i = 1 ÷ 96); WTP_i is WTP of respondent at I; β_0 is intercept; β_j is coefficients (j = 1 ÷ 6); Edu is education; Inc is per capita income; Ag is age; D_1, D_2, D_3 and D_4 are variables of specific occupations (governmental employment, private business, farming and small-sized production, respectively); and u_i is random error consistent with independent normal distribution with the mean value of zero.

The *Weighted Average Method* was employed to define the average WTP of 96 households and was expressed in the formula shown below:

$$\overline{wtp} = \frac{\sum_{k=1}^{5} wtp_k \times n_k}{\sum_{k=1}^{5} n_k} \quad (3)$$

where $\overline{WTP}$ is the mean WTP of 96 households, k is the value of different payment levels (k = 1 ÷ 5), WTP_k is the WTP at i, and n_k is the number of households corresponding to WTP_k.

3. RESULTS AND DISCUSSION

3.1. Willingness to pay and reasons

The data on WTP and its reasons were collected by means of household survey with structured questionnaire. Five ranges of WTP were set beforehand, and respondents were requested to select one from five ranges. The survey results presented in Table 1 showed that 60 out of 96 surveyed households (accounting for 62.5 %) were willing to pay at 17,000 VND/month, which is equivalent to the environmental sanitation fee currently applied in the study area. There was only 1 household willing to pay at the range of 26,000 to 29,000 VND/month. None of households was willing to pay for the highest range of 30,000 VND/month and above. Using the *Weighted Average Method* noted above, the mean WTP of 96 households was defined at 18,440 VND/month.

Table 1. WTP of surveyed households.

WTP levels (k)	WTP_k (VND/month)	Number of household (n_k)	Percentage (%)
1	17,000	60	62.5
2	18,000 ÷ 21,000	25	26.04
3	22,000 ÷ 25,000	10	10.42
4	26,000 ÷ 29,000	1	1.04
5	30,000 and above	0	0
	Total	**96**	**100**

In fact, each household was willing to pay for different reasons. Among 36 respondents agreed with the WTP level higher than 17,000 VND/month, 23 of them representing 64 % said that they wanted to have a clean and tidy surroundings. Fourteen from 36 respondents (making up 39 %) claimed that they were willing to pay for the purpose of securing their health. For any reasons, the local residents always showed their big concern over the solid waste management and wished to live in a healthy environment.

However, there remained a considerable number of respondents unwilling to pay at the higher fee for environmental sanitation. Sixty out of 96 surveyed households, accounting for 63.5 %, didn't agree with the increased fee. They said their incomes were still low, and the present fee was consistent with their income. Some of them held that the amount of money taken from the increased fee might not be used appropriately.

3.2. Determinants of willingness to pay

Regression model for willingness to pay

As mentioned above, 4 key determinants of WTP, which include income (Inc), occupation (Occ), age (Ag) and education (Edu) were employed to build up the regression model to investigate their influences on WTP. The analysis results of coefficients was indicated in Table 2, and the regression analysis of determinants was presented in the following equation:

$$WTP = 12.53 + 0.13Edu + 0.001Inc + 0.03Age - 0.14D1 + 0.82D2 + 0.24D3 + 1.62D4$$

Table 2. Outputs of regression statistics for 4 determinants.

Coefficient	Value	T - statistic	Confidence level (%)
Intercept	12.53	12.21	100
Age	0.03	2.08	95.9
Education	0.13	1.68	90.4
Income	0.001	6.41	100
D1 (governmental employment)	0.82	1.76	91.8
D2 (business)	- 0.14	- 0.28	22.2
D3 (farming)	0.24	0.57	42.9
D4 (small-sized production)	1.62	1.66	90.0
R Square	0.68	-	-
F statistic	27.26	-	-
F critical	2.13	-	-
Observations	96	-	-

In order to conclude whether or not the regression model was statistically significant, the *F statistic* was compared with *F critical*. If *F statistic*'s value is higher than that of *F critical*, then the regression model shows its statistical significance. In this study, *F statistic*'s value = 27.26 and *F critical* = $F_{0.05}$ (7.88) = 2.13. This means that the study regression model was definitely statistically significant.

In addition, the R square got a value of 0.68; i.e. 4 variables in the regression model contributed 68 % to the variation of WTP. The remainder of 32 % was made by other variables which were not included in the regression model.

Determinant of income

A number of previous studies showed that WTP was much dependent on the per capita income [1, 5]. The positive sign (+) of income coefficient and the confidence level of 100% (Table 2) meant that in the event the other variables were unchangeable, the income was directly proportional to the WTP. In other words, the households with higher incomes were willing to pay higher fee. As a matter of fact, people with higher income often showed their greater concern over the environmental quality.

According to the survey results, most of households with highest per capita income of more than 3,500,000 VND/month were willing to pay at 22,000 ÷ 25,000 VND/month. The majority of households having lowest per capita income (less than 2,000,000 VND/month) were in favor of the lowest WTP level (17,000 VND/month). The average WTP calculated based on household's per capita income was illustrated in Figure 1.

Determinant of education

The education of respondents was broken up into 5 levels: illiteracy, primary school, secondary school, high school and higher education. The positive sign (+) of education coefficient indicated in Table 2 showed that in the event the other variables were fixed, the

education levels were directly proportional to the WTP. The corresponding confidence level of 90.4% was not so high in this case; however, the correlation between WTP and education was acceptable since the sample size was not large enough to totally reflect the influence of this determinant.

The analysis results in Figure 2 showed that the WTP levels of respondents with primary school and secondary school were almost similar (17,170 VND/month as compared to 17,210 thousand VND/month). Between the high school and higher education, the former's WTP (20,640 VND/month) was lower than that of the latter (23,500 VND/month).

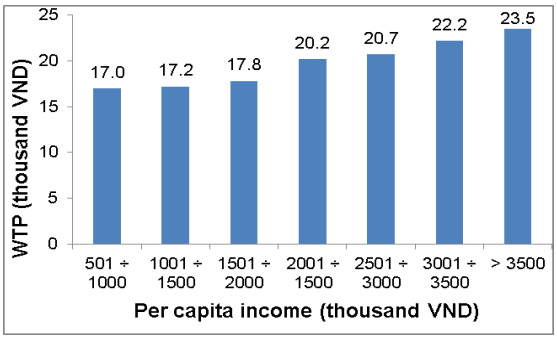

Figure 1. WTP at different income levels.

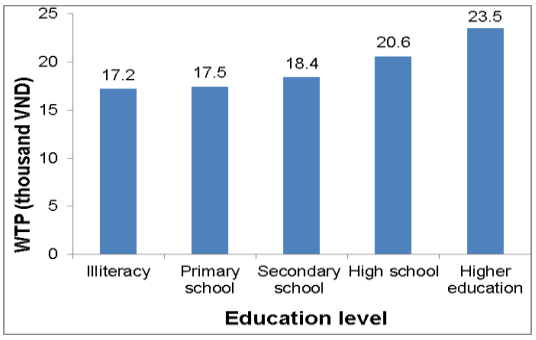

Figure 2. WTP at different education levels.

Determinant of age

WTP was also affected by the age of respondents, but to some extent only. Given the confidence level of 95.9 % (Table 2), the variable of age was statistically significant. The analysis results showed that the respondents of over 60 had the highest WTP (20,880 VND/month). This was interpretable since when people get older, they usually wish to live in a healthy environment.

The lowest WTP; however, felt into the group aged 31 to 45 years old (17,780 VND/month) rather than the group of 18 to 30 (18,500 VND/month) (Figure 2). This was probably due to the fact that the group between 18 and 30 years old included young respondents who were more open-minded, dynamic and enthusiastic about the environmental protection.

Determinant of occupation

The WTP at different occupations was presented in Figure 4. The statistical analysis results indicated that even though the confidence level of 91.8 was not so high (Table 2); however, it partly revealed that the WTP of respondents working for government (D1 = 20,230 VND/month) was higher than that of non-governmental working group (D2, D3 and D4 = 18,520 VND/month). In reality, for those respondents who were working for the government, they were more accessible to the environmental legal documents as well as governmental policies; and their education levels were higher. As a result, they became more aware of their environmentally friendly responsibility as well as behavior.

Among non-governmental working groups, the small-scale production households (D4) had the highest WTP (20,330 VND/month), and their WTP was even a little higher than the that of governmental working group. This was simply because the small-scale producers were fully aware of their waste amount released into environment and their legal penalty in case they didn't observe the concerned regulations on solid waste management.

The coefficients of D2 (private business) and D3 (farming) presented in Table 2 were not

statistically significant showing the fact that the respondents of these groups were not so concerned about the environmental sanitation fee. Thus, their WTPs were relatively low.

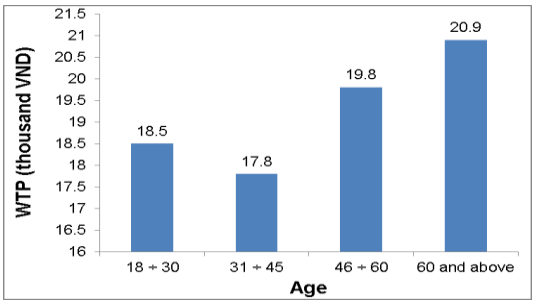

Figure 3. WTP at different ages.

Figure 4. WTP at different occupations.

In particular, the above analysis results can help the local authorities in formulating proper solid waste management services while generally can add up its role for the improvement of environmental quality.

4. CONCLUSION

The socio-economic characteristics of respondents, namely per capita income, occupation, age and education showed that they had significant influences on the WTP of local residents for solid waste management services in Loc Ninh commune. Among them, the per capita income proved to be the most significant determinant with a confidence level of 100%. Based on such analysis results, a socially acceptable fee which the majority of people are willing to pay for should be set to contribute to the improvement of solid waste management services.

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